



Leibniz-Rechenzentrum

der Bayerischen Akademie der Wissenschaften



Systems Controls @lrz.de

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Agenda

- **Introduction**
- **Power Infrastructure**
- **Cooling Infrastructure**
- **IT systems**
- **Issues @lrz.de**
- **Discussion**

Munich

Bavaria

Germany & Europe

- We provide generic IT services to all Munich universities
- We provide special IT services to all universities in Bavaria
 - Network, High Performance and Grid Computing
 - Backup and Archive Services
 - IT Management
- We provide supercomputing resources to scientists in Europe
 - Member of the German Gauss Supercomputing Centre
 - Part of the European HPC Infrastructure PRACE
 - Operating Tier-0 Supercomputing Center (SuperMUC system)
 - Investigations on Future HPC Systems:
 - Hardware Architectures
 - Programming Models & System Software
 - Zero Emission Data Center
 - Re-Use of Waste Heat

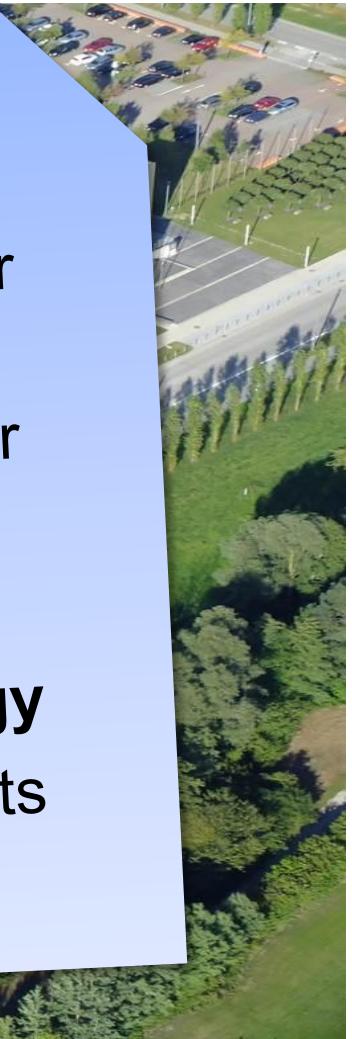
SuperMUC: IBM System x iDataPlex With Direct Water Cooling



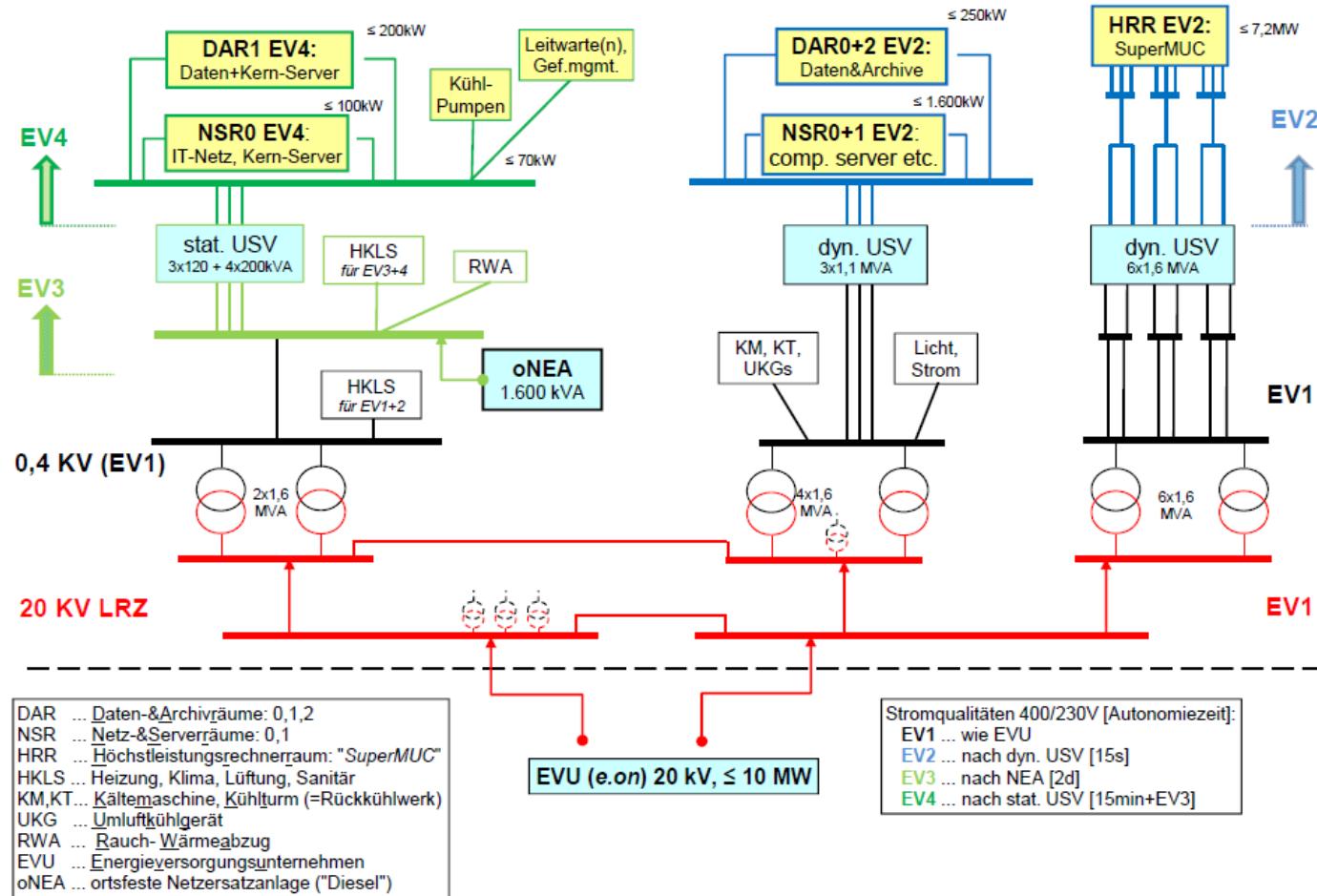
iDataPlex DWC Rack w/ water cooled nodes
(rear view of water manifolds)

Some more Facts

- **3160.5 m²** (34 019 ft²) IT Equipment Floor Space (6 rooms on 3 floors)
- **6393.5 m²** (68 819 ft²) Infrastructure Floor Space
- **2 x 10 MW** 20kV Power Supply
- **Powered Entirely by Renewable Energy**
- **> 400 000€** (> 550 000 \$) Electricity Costs per Month



Layout Power Infrastructure



Controls Power Infrastructure

- **Equipment:**

- Transformer, switching, ...: SIEMENS
- Dyn UPS: Piller
- Battery backup: Emerson
- Diesel generator: MTU



- **Metering**

- SOCOMEC&WinCC (power)
- Piller&WinCC (power, messaging)
- JCI Metasys M5 (power)
- deZem (power)
- SWM - Utility Provider (power)

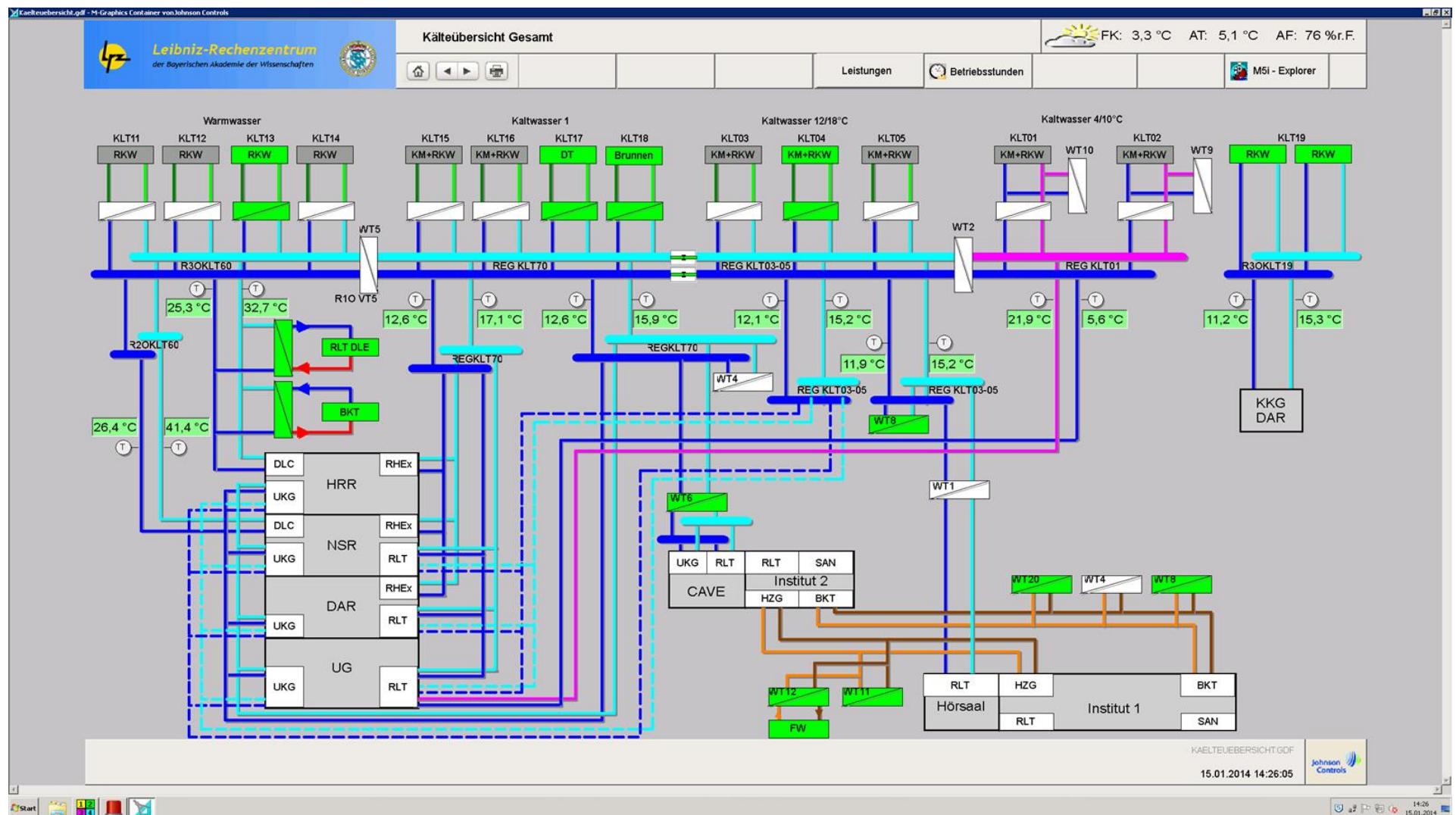


- **Monitoring**

- Siemens WinCC

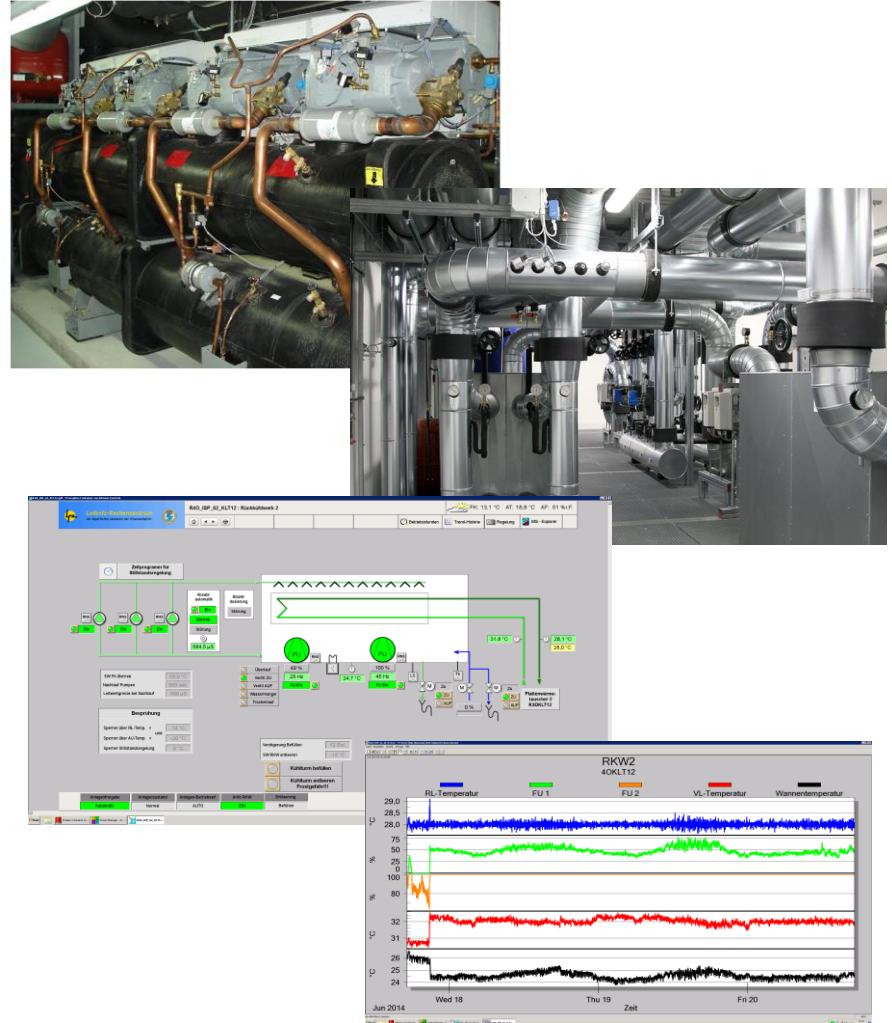


Layout Cooling Infrastructure



Controls Cooling Infrastructure

- **Equipment:**
 - Cooling towers: Gohl, Jaeggi
 - Chiller: McQuay, CARRIER
 - CRAC/CRAH: GEA, WEISS, STULZ, RC Group
 - Pumps: Grundfos/ABB&KSB
- **Metering**
 - Krohne (flow)
 - Calec (heat)
 - WIKA a.o. (pressure, temperature)
- **Monitoring & Operations**
 - JCI Metasys



Monitoring of IT Systems

- **SuperMUC**
 - Vendor solution: IBM tool set based on icinga
 - Power and energy readings at server (PDU & Paddle cards & RAPL counters) and system level
 - Temperature at server level and room level
 - Pressure/heat at system level
- **CoolMUC**
 - Vendor solution: power/heat/temperature/flow control
- **Clusters & servers, NAS systems**
 - Nagios based inhouse tools
- **Tape libraries**
- **Networking**

- **Power infrastructure**
 - Monitoring, reporting (dashboard)
 - Quality of reported measurements
- **Cooling infrastructure**
 - Ops of cooling loops (hydraulics, meta controls)
 - Ops of cooling towers
- **Information management**
 - Integration&consolidation of heterogeneous data sources
 - Interoperatorbility of differing system controls
- **General**
 - Interaction with vendors/contractors of BMS
 - Strategy DCIM: in house/vendor based, open source

Topics of Interest

- Requirements of liquid cooled systems for BMS
- Requirements of large HPC systems for systems control
- Roadmaps for BMS and DCIM
- Vendors view on status and trends in system controls
 - Standardization
 - APIs
- Lessons learned and white paper on
„Best practise in systems controls for HPC data centers“



Thank You!

Zero Emission Supercomputing Centre



Overview Cooling Infrastructure

